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(19)

(54) ASBESTOS-FREE DRYWALL JOINT COMPOSITION

(71) We, NATIONAL GYPSUM COMPANY, a corporation organised and existing under the laws of the State of Delaware, United States of America, of 325 Delaware Avenue, City of Buffalo, County of Erie, State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to drywall joint treatment compositions which have been improved only in an ecological sense. Drywall joint compositions have substantially all included a portion of asbestos fibers in the formulation. A definite effort is being made to eliminate asbestos fibers in products of all kinds, where these fibers have heretofore been commonly used, due to the belief that asbestos fibers, particularly if inhaled, are dangerous from a health standpoint.

Asbestos fibers have been considered an essential ingredient in joint compositions including the kinds sold in dry powder form for subsequent addition of water and the kinds sold as a ready-mixed aqueous paste. The asbestos fibers have been considered critical in order to obtain the following combination of characteristics all as desired for a preferred joint composition:

1. The plasticity of the paste
2. The water-holding capacity as related to what is referred to as open time and wet edge
3. The avoidance of excessive cohesiveness of the paste
4. Viscosity stability during mixing, storing and use.

The plasticity of a joint composition is seen in the ability of the paste to be easily shaped into a smooth surfaced layer with uniform tapered edges using a common broad knife. The water-holding capacity desired is such that when the paste is applied to a dry paper-covered gypsum board surface, the paste does not give up its water to the blotter-like effect of the gypsum board paper, at least for a time sufficient for a worker to complete his smoothing-out operation with the broad knife. The cohesiveness of the paste should be sufficient to prevent any tendencies of the paste to be pulled apart by the broad knife as the knife is being firmly pressed against the paste and pulled along the surface, however it should not resist the ease of deformation by the knife into the desired smooth coating formation. Although it is no problem to form a paste with an initial viscosity after mixing of substantially any form, the presence of asbestos fibres has been of importance in providing a paste which does not slowly but steadily change in viscosity subsequent to mixing or even during mixing, if, for example, mixing were inadvertently prolonged.

In accordance with the present invention, there is provided a joint composition free of asbestos fibre, comprising by dry weight, from 50 to 99 percent of finely powdered inorganic filler other than attapulgite clay, from 1 to 50 percent of a binder for said filler, from 0.1 to 5 percent of an organic hydrophilic thickener other than the binder, from 0.1 to 5 percent finely powdered attapulgite clay and a flocculating agent for said clay other than the binder of the organic hydrophilic thickener in an amount of 0.1 to 5.0 parts by weight for every 10 parts by weight of attapulgite clay.

Joint compositions of the present invention are provided, free of asbestos, which provide all the characteristics of a joint composition containing asbestos. The asbestos of prior formulations is replaced by approximately the same weight of a finely powdered attapulgite clay. A smaller quantity of a flocculating agent for the clay, preferably polyacrylamide resin is also added.

Referring to the drawing there is shown a short section of a drywall joint area 10 on which ready-mix joint composition 12 is

being hand applied, using a broad knife 14, forming a smooth-surface top coat 16.

The joint composition 12 shown is made in accordance with the invention however it is applied in the same way, and appears the same, as prior joint compositions.

There are also shown a bed coat 18 of joint composition 12 and a first finish coat 20 of joint composition 12, both of which have hardened and dried prior to the application of the smooth-surfaced top coat 16. Bed coat 18 and first finish coat 20 can both be made from the same asbestos-free ready-mix joint composition 12 as is top coat 16. The bed coat 18 has a narrow paper joint tape 22 embedded within it to provide a reinforcement of the final joint treatment along the joint 24 between the two gypsum wallboards 26.

The joint composition 12 is an asbestos-free paste formulation suitable for manufacture in paste form, storage, shipment and then ultimate use, all as has been accomplished heretofore with asbestos-containing ready-mix joint compositions.

EXAMPLE 1.

Joint composition 12 may be made in accordance with the following formulation:

	Parts by Weight
Polyvinylacetate latex binder (58% by weight solids)	6.0
Dipropylene glycol dibenzoate plasticizer	0.55
Fine ground limestone	38.0
Dry ground mica	14.2
Fine ground attapulgite clay	1.5
Polyacrylamide resin	0.12
Hydroxypropyl methylcellulose	0.48
Water	39.15
	100.00

The polyvinyl acetate binder employed was Union Carbide (Registered Trade Mark) Latex WC 130. Many other binders can be substituted as is well known in the art, including other latex emulsions, starch and caseins. Dipropylene glycol dibenzoate plasticizer, which is preferably used in conjunction with the polyvinyl acetate binder, was obtained as Benzoflex 9-88 from Velsicol Chemical Corporation.

The fine ground limestone had a fineness of between 80% by weight and 99% by weight through a 325 mesh U.S. Standard Sieve. The dry ground mica was Asheville Mica Company's grade AMC. The limestone, mica and the clay are all fine inorganic filler materials each contributing certain physical characteristics to the final product, as fine inorganic filler materials have in prior joint compounds.

The fine ground attapulgite clay is available from Engelhard Minerals and Chemicals Corporation and is identified as Attagel attapulgus clay, and is preferably Attagel 40. A typical chemical analysis of the Attagel 40 is:

	by weight
SiO_2	68.0%
Al_2O_3	12.0%
MgO	10.5%
Fe_2O_3	5.0%
CaO	1.7%
P_2O_5	1.0%
K_2O	1.0%
TiO_2	0.7%
Trace Elements	0.1%
	100.0%

The major constituents shown in the above analysis are combined as complex magnesium aluminum silicate and do not exist as free oxides.

The average particle size of the Attagel 40 is 0.14 micron, and 65% by weight of the material is finer than 0.2 micron. There is about 12% by weight free moisture and about 22% ignition loss at 1800°F. It has a pH in the range of 7.5 to 9.5, a specific gravity of 2.36 and has a light cream color.

The polyacrylamide resin can be obtained from Dow Chemical Company identified as Dow (Registered Trade Mark) Resin 164. The polyacrylamide resin, used in combination with the attapulgite clay, in substitution for the asbestos of prior ready-mix joint compositions has produced the nearest equivalent in respect to the physical properties to which asbestos has been known to contribute. Without the polyacrylamide, considerably more work must be expended in the mixing in order to cause the attapulgite clay to thicken sufficiently. Other flocculating agents that can be substituted for polyacrylamide, with somewhat less success are Hercules Reten (both Registered Trade Marks) 210, a copolymer of acrylamide and an acrylic, or Union Carbide's Polyox (Registered Trade Mark) WSR-35, a polyethylene oxide.

The hydroxypropyl methylcellulose may be Dow Chemical Company's Methocel (Registered Trade Mark) HG 228, which provides a known thickening function in join compositions. The amount of water may be varied, with variations in the amount of other ingredients, in order to provide the desired viscosity of joint composition of 400 to 700 Brabender units.

EXAMPLE 2

The following is a formulation for ready-mix joint composition which includes asbestos and functions closely similar to the formulation of the invention hereabove.

	Parts by Weight
Polyvinyl acetate latex binder (58% by weight solids)	6.1
Dipropylene glycol dibenzoate plasticizer	0.56
Fine ground limestone	39.2
Dry ground mica	14.7
Asbestos (Union Carbide SG 210 Calidria)	1.6
Hydroxypropyl methycellulose	0.49
Water	37.35
	100.00

As will be seen the two formulas are substantially the same except for the replacement of asbestos with attapulgite clay and the addition of some polyacrylamide resin with the attapulgite clay. The ready-mix joint composition may comprise 50 parts by weight filler, 6 parts by weight polyvinylacetate latex binder, a plasticizer for said binder, 1 part by weight of attapulgite clay, 0.1 parts by weight of flocculating agent, 0.5 parts by weight of organic thickener and 40 parts by weight of water.

The formulation of a joint composition in accordance with the invention, may include for example, 1% by weight starch binder, 5% by weight non-fibrous talc, .1% defoaming agent or .5% propylene glycol antifreeze, or mixtures thereof.

The mixing of the ingredients of the ready-mix joint composition 12 is of importance. In the preferred method, substantially all of the water is put into the mixer first. As the other ingredients are added, the mixing of the ingredients with the water and with each other is carried on. Approximately half of the limestone is withheld from the mixer until the other ingredients are all in the mixer being mixed.

Whereas the description above of what is shown in the drawing describes a ready-mix joint composition 12, it will be understood that the drawing is also suitable for understanding the use of a dry powder formulation which is in accordance with the present invention. A dry powder formulation as disclosed herebelow may be mixed with water and is then used in exactly the same way as ready-mix joint composition 12.

EXAMPLE 3

A suitable dry powder formulation within the invention is as follows:

	Parts by Weight
Polyvinyl alcohol binder	1.0
Fine ground limestone	38.0
Dry ground mica	14.0
Fine ground attapulgite clay	1.4
Polyacrylamide resin	.12
Hydroxypropyl methylcellulose	.48
	55.00

The above dry powder formulation, when mixed with about 45 parts by weight of water will produce an on-the-job mixture of joint composition which performs quite similar to prior dry powder formulations containing asbestos.

In order to compare the above formulation with a most comparable asbestos-containing formulation, the attapulgite clay and the polyacrylamide resin may be omitted and 1.4 parts by weight of Union Carbide's SG 210 Calidria asbestos is added. The characteristics which are most important in evaluating a comparison of these products are ones which are not described in numerical values that can be compared. These characteristics are judged by feel and by actual use of the join compositions and comparison of the finished products.

Minor amounts of dry preservative defoaming agents and other known additives may also be incorporated in the dry formulations made in accordance with the invention, similar to their use in prior asbestos-containing dry powder formulations.

Joint compositions made in accordance with the invention have been found to approach the characteristics and qualities of prior joint compositions containing asbestos closer than any other known asbestos-free formulation.

WHAT WE CLAIM IS:—

1. A joint composition free of asbestos fibre, comprising by dry weight, from 50 to 99 percent of finely powdered inorganic filler other than attapulgite clay, from 1 to 50 percent of a binder for said filler, from 0.1 to 5 percent of an organic hydrophilic thickener other than the binder, from 0.1 to 5 percent finely powdered attapulgite clay and a flocculating agent for said clay other than the binder or the organic hydrophilic thickener in an amount of 0.1 to 5.0 parts by weight for every 10 parts by weight of attapulgite clay.

2. A joint composition according to Claim 1 wherein said flocculating agent is a polyacrylamide resin.

3. A joint composition according to Claim 1 comprising 50 parts by weight of filler, 1 part by weight polyvinyl alcohol, 1

part by weight fine attapulgite clay, 0.1 part by weight flocculating agent for said clay and 0.5 parts thickener.

4. A joint composition according to Claim 3 wherein said flocculating agent is a polyacrylamide resin.

5. A joint composition according to any preceding Claim, wherein the attapulgite clay has a particle size such that a 65% by weight thereof is finer than 0.2 micron.

6. A joint composition substantially as herein described with reference to the Examples 1 and 3.

7. A ready-mix joint composition including the composition of any preceding Claim which has been thoroughly mixed into a paste with sufficient water to produce a paste viscosity of 400 to 700 Brabender units.

8. A ready-mix joint composition according to Claim 7, comprising 50 parts by weight filler, 6 parts by weight polyvinylacetate latex binder, a plasticizer for said binder, 1 part by weight of attapulgite clay, 0.1 parts by weight of flocculating agent, 0.5 parts by weight of organic thickener and 40 parts by weight of water.

9. A method of making a ready-mix joint composition as claimed in Claim 7 or Claim 8 using a joint composition, according to any of Claims 1 to 6, comprising the steps of placing a substantial portion of water in a mixer, adding the other ingredients in the necessary amounts except a substantial portion of the finely powdered inorganic filler, mixing the ingredients and water, adding the balance of the filler and then mixing all the ingredients thoroughly.

10. A method of making a ready-mix joint composition according to Claim 9 substantially as herein described with reference to Examples 1 and 3.

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